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Territorial development and mining. Insights and challenges from the Chilean case

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ABSTRACT

As mining activity generally occurs far away from metropolitan areas, governments tend to forget the problems that communities in mining regions face. Centralized government systems and, more importantly, a lack of a robust understanding of the effects of mining impacts on communities and regions, explain in part the lag of development in mining regions and countries. This paper discusses these aspects and introduces eight different papers (comprising the Special Issue: *Territorial development and mining in Chile*) discussing the impacts that mining activity brings to local economic activity and societal outcomes using the case of Chile, one of the most important mining countries in the world. We conclude this invitation to a territorial turn in the study of mining-based economic development with a set of key research topics we believe would benefit from further research to improve our understanding of the temporal and spatial dynamics between mining activity and development across territories.

1. Introduction

A growing body of literature has stressed the opportunities that extractive activity can bring to economic development (Lederman and Maloney, 2007; Morris et al., 2012; Venables, 2016), challenging the so called resource curse thesis (Auty, 1993; Sachs and Warner, 1995). Applying a regional perspective to the resource curse debate, other authors argue that the issue is far from solved, pointing to many potential negative impacts that mining can bring to the socioeconomic sustainability of territories (Fleming et al., 2015; Phelps et al., 2015; Badeeb et al., 2017; Auty and Furlonge, 2019). Hence. How to turn mining richness into a blessing remains, in most cases, a matter related to institutional and policy design. In this respect, it is remarkable that research about mining-based economic development has primordially used the nation/state as the basic and natural unit of analysis, leaving the regional and urban scales either aside or playing a secondary role, mostly concerned with the compensation of negative externalities suffered by the local communities directly involved in the extraction process. The predominance of this type of methodological nationalism has been criticized by Bridge (2008), Fleming et al. (2015) and Phelps et al. (2015) because it pushes questions about the interaction of the global, national and sub-national scales in the organization of mining production into the background. This lack of research into the understanding of how the economic development of mining regions and cities can contribute both to local and national prosperity is a relevant gap because most of the value added generated by mining concentrates in a small number of places within countries where mineral deposits are located.

The aim of this paper is to expand on the discussion of the restrictive national-oriented research approach and to stress the need of a territorial turn in the analysis of mining-based economic development to enrich and complement the dominant national perspectives. We also discuss here the papers published in this journal under a special issue (SI) exploring the link between extractive activity and regional development in Chile – named 'Mining and territorial development in Chile'.[1] Chile is one of the most important mining countries in the world that has been praised as a success story of mining-based economic development and entrepreneurial achievements (OECD/UN, 2018). This praising narrative, however, is based on macroeconomic and firms' performance indicators and usually hides the experience of the Chilean mining regions and cities, mostly concentrated in the northern part of the country. When the territorial dimension is considered, the Chilean story is more complex and not always so bright. A long history of economically

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[1] Papers of this SI can be found here https://www.sciencedirect.com/journal/resources-policy/special-issues.

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unsustainable urban mining agglomerations is manifested in the ruins of old nitrate company towns and it is still controversial. Nowadays, it is still debatable whether the Antofagasta Region, which represents more than 50 percent of the national mining output, resembles more an extractive enclave than a cluster (Lagos and Blanco, 2010; Arias et al., 2014). The scarce attention paid to the territorial dimension of mining-based economic development in Chile is translated into its policy design. For instance, it is remarkable that the Chilean mining development strategy, which claims to have the objective of transforming the Chilean extractive activity into an "innovative, sustainable and inclusive" industry (Gobierno de Chile, 2014; Fundación Chile 2016), almost does not mention regions, cities or territory as part of its central goals.

The 'Mining and territorial development in Chile' SI contains studies from authors of different Chilean and international universities, who provide a range of evidence and insights that help to better understand the contribution and challenges that mining has brought to Chile from a territorial perspective. In this paper, we summarize and discuss the main findings of the research presented in the SI, which we complement by discussing the need of a territorial turn in the studies about mining-based economic development and by contrasting mining activity to place-based mechanisms to promote growth and prosperity across regions.

This paper is structured as follows. In the second section we focus on the relevance of approaching the resource curse thesis and mining-based economic development strategies at different spatial scales. Section three briefly describes the Chilean experience both from a national and territorial perspectives, drawing most of the discussion from the insights of the SI. Section four summarizes some of the main findings of the articles published in the SI and, accordingly, we analyze some of the main dimensions of territorially oriented mining-based development policies for the case of Chile. Section five concludes and points to topics of future research.

2. A territorial turn to the resource curse thesis

Focusing on the economic impacts of resource extraction, a large and growing body of literature has analyzed the natural resource curse thesis, which relates to the inability of resource-rich countries (or regions) to economically grow as fast as non-resources economies (Sachs and Warner, 1995; Mikesell, 1997; Anderson, 1998; van der Ploeg, 2011; Cai and Newth, 2013; Fleming et al., 2015). Among this literature, many scholars have found evidence that natural resources windfalls worsen economic development (Sala-i-Martin and Subramanian, 2003; Carmignani, 2013), although discrepancies exist in terms of the real causes of these negative effects, with some authors considering that resources are more a blessing – they produce positive economic outcomes – than a curse (e.g. Aragon and Rud, 2013; Allcott and Keniston, 2014).

Although in some cases researchers have found that resources provide a blessing for certain economies, there exist agreements that tracking and addressing the potential causes of the curse are important tasks for both national and regional planners in order to obtain positive dividends from resource exploitation (Collier et al., 2010; Auty and Furlonge, 2019). In a comprehensive review of the empirical and theoretical literature, van der Ploeg (2011) analyses evidence of popular hypotheses explaining the channels through which resources can negatively affect the economic performance of nations or regions. These include: (1) appreciation of exchange rates (Dutch disease), (2) temporary loss of learning by doing, (3) poor institutions, (4) authoritative political systems, (5) corruption, (6) anticipation of better times and negative genuine savings, (7) volatility of international commodity prices, (8) rent seeking behavior, and (9) unsustainable policies (see also Fleming et al., 2015).

One common theme in the resource curse literature is that the vast majority of empirical analyses rely on cross-country models to provide insights into the relationship between resources and economic development. In contrast, evidence of the local economic impacts of resources extraction across regions and cities of a country is much scarcer in the economic literature. From an empirical perspective, this imbalance is somewhat surprising, given that it has been acknowledged that within-country models are more robust than cross-country analysis as the former allow researchers to "… exploit variation within a country where variables that might confound the relationship between resources and macroeconomic outcomes do not vary and the danger of spurious correlation is minimized" (van der Ploeg, 2011: 381).

From a theoretical perspective, there are also many arguments that make reasonable to abandon the methodological nationalism and to complement it with a wider and deeper consideration of the regional and urban scales of mining-based economic development. First, most negative externalities of extractive activities are place-specific and have direct environmental, economic and social implications for the regions and cities that are close to the mineral deposits. These externalities are not usually considered in the national analysis of the resource curse that tend to be based on macroeconomics indicators (van der Ploeg, 2011). Furthermore, the extractive activities are organized as increasingly complex networks (Bridge, 2008), where the global, national and sub-national scales are strongly interconnected and play different roles in the production process. How mining regions are integrated in these global production networks can be a crucial element of local and national competitiveness, as well as contribute to increasing the value added that is nationally captured (Coe and Yeung, 2015). In this respect, it is also widely recognized that knowledge creation is a location specific process (Iammarino and McCann, 2013) and that, in this sense, proximity to the deposits could play a relevant role in the promotion of technology intensive linkages and innovation. Paradoxically, the development of clusters in mining regions, which received increasing attention during the 1990′s, when mineral prices were relatively low (Arias et al., 2014), were not considered a relevant element of mining-based development strategies during the first decade of twenty-first century when prices rose during the so called mining prices supercycle. In fact, these empirical and theoretical elements in favor of a more territorially oriented mining economic development have been usually ignored in the predominant nation-based analyses and have not allowed us to understand to what extend the extractive industry is able to promote economic development, innovation and diversification at a sub-national scale.

Mining regions face significant challenges related to their environmental, economic and social sustainability. These challenges have been historical features of mining regions; however, in the last decades technology and the transformation in the organization of the extractive industry as a global network have produced a progressive "hollowing out" of mining regions in terms of the location of service firms related to the extractive industry (Fleming and Measham, 2014; Phelps et al., 2015; Breul and Revilla Diez, 2018; Parker and Cox, 2018; Atienza et al., 2020) and the development of local labor markets (Aroca and Atienza, 2011; Rolfe, 2013; Storey, 2018). The increasing use of long distance commuting by means of fly-in fly-out or drive-in drive-out dynamics (Paredes et al., 2018) and the specialization of the main cities of mining countries in technology and financial services have reduced the possibility of mining regions and cities of benefiting from agglomeration economies through linkages and thick labor markets. This trend in the organization of mining production, together with the increases in output during the mining prices super cycle, has significantly increased the specialization of mining regions and cities in the extractive activity itself, which make them more sensitive to commodities price volatility –feature that has been considered one of the main traits of the resource curse at a national level (van der Ploeg, 2011). In this sense, volatility can not only condition growth but it also affects the capabilities installed in local firms and their innovation capacity and diversification. This is an issue that has been proved extremely difficult in peripheral regions, even in developed countries (Isaksen, 2015).

Mining regions also face higher costs than other regions/cities in the

respective country. Given that mining salaries situate above the median salary in a country, services and housing are generally more expensive in mining regions. This, in addition to the typical remoteness of mining towns, reduce the incentives of non-mining manufacturing and companies to locate in mining regions, affecting the diversity and quality of jobs. This issue adds an additional socioeconomic impact on the quality of life of mining regions (Measham et al., 2016). This higher cost is one aspect that has led to the need of mining companies to have a 'Social License to Operate' (SLO) as well as public policies that require to be specific to the communities and the places where mining activity takes place.

As it occurs with the resource course thesis at a national level, it would be too fatalistic to think that mining regions and cities are doomed to failure. At the same time, however, it would be too naïve to expect that overcoming the resource curse at a sub-national level would be possible without an appropriate institutional set-up and complementary national and place-based policies. In fact, the lack of development of most mining regions can be seen as a manifestation of what Auty and Furlonge (2019) call a "rent curse" where domestic institutional and political factors are organized to capture the rents of mining activities by the main urban agglomerations, mining companies and some groups of workers to the detriment of mining territories. While this rent curse of mining regions seems to be persistent, it is not deterministic and there is room for institutional reforms and place-based policies to promote local development in mining territories. In this respect, the OECD (2017) has identified three key policy areas to manage the challenges that mining regions and cities face: (1) National and place-based policies oriented towards the integration of mining regions and cities in global value chains by means of increasing linkages, innovation and the search of new diversification paths related to mining activity; (2) good practices to increase quality of life and well-being in mining territories; and (3) institutional set-up and governance practices that regulate, on the one side, the complex relationship between the national and sub-national scales within mining countries, and, on the other side, the interaction between the mining industry and local stakeholders. In the final section of this paper, we focus on some of these types of policies for the case of Chile, taking into account the main findings of the articles published in the SI.

3. Paradoxes of national and territorial mining-based economic development in Chile

The extractive industry has shaped the Chilean economy since its beginning as country. During the nineteenth century, silver and nitrate were the main sources of mining revenues for Chile. After the nitrate crisis in the 1920s and thanks to the incorporation of US investment in the following decades, copper became the main mining commodity and driver of national and economic growth. Chile was not immune to the wave of resource nationalism internationally experienced by the mining industry between the 1960s and the 1970s and nationalized all copper mines in 1971, during Salvador Allende's government. Strong economic dependence on extractive activity remained during Augusto Pinochet's dictatorship, between 1973 and 1990. In 1976 the public company CODELCO was created, which remain till nowadays the largest copper mining company in the world. During Pinochet's dictatorship, however, mining development was also importantly sought by the privatization of mines and the attraction of Foreign Direct Investment (FDI). It was, however, after the return to democracy in the1990s, when the largest amounts of mining FDI arrived to the country with the installation of many of the world largest mining multinationals. During the twenty-first century, mining is still greatly shaping the Chilean economy. In fact, during the first decade of this century Chilean dependence on mining industry increased due to the windfall revenues that came from the mining prices super cycle between 2005 and 2011. In 2018, mining represented 10.1 percent of national GDP, 55.8 percent of total exports, and almost a third of national FDI between 2006 and 2015 (COCHILCO, 2019).

Chile is the world's largest copper producer in the world, representing around 28 percent of global output (COCHILCO, 2019) and possessing around 40 percent of global reserves in 2018 (SERNAGEOMIN, 2019). Chile is usually considered a successful case of mining-based economic development particularly in terms of growth and macroeconomic stability (OECD/UN, 2018; Auty and Furlonge, 2019). However, this mining success history has several controversial aspects ranging from both a national perspective and particularly from and regional and sub-national perspective. At a national level, mining industry in Chile is facing increasing costs of production, limited access to energy sources and decreasing productivity and mining production linkages (Comisión Nacional de Productividad, 2017; Castaño et al., 2019). Furthermore, the historical macroeconomic and political stability, considered one of the main virtues of the Chilean economy, is currently challenged due to the recent social and political upheaval that started in October 2019 and the COVID-19 pandemic. It has been argued that the main cause of the "Chilean social outbreak" and social impacts of the pandemic has been supported by the large inequity (or inequality) across several dimensions, one of the traditional symptoms of the resource curse. At the same time, the Chilean economy has not been able to leapfrog and become a competitive knowledge-based economy during the last three decades. It is widely acknowledged that the country has not been able to develop a globally competitive mining services suppliers' industry, has a limited capacity of mining innovation, and has not been able to diversify its economy maintaining a strong dependence on primary activities and particularly on mining exports (Gobierno de Chile, 2014; Phelps et al., 2015; Comisión Nacional de Productividad, 2017; Auty and Furlonge, 2019).

Despite some of the mining regions in Chile present higher income level than the rest of the country (Atienza et al., 2020; López and Aroca, 2019), most of the aforementioned problems that mining industry is facing in Chile as a country are also present at a subnational level in mining regions and cities, even at a greater scale specially in terms of lack of diversification, strong dependence on extractive activity and lack of innovation capacity. All these aspects are evidenced and discussed in the papers of this SI. Additionally, there are several problems that have a specific territorial nature and need to be considered to achieve a mining-based local economic development. One the main territorial problems that mining regions are facing in Chile is related to the economic and demographic concentration around Santiago, the capital and by far largest city (hosting almost half of whole population) in the country. This expression of spatial inequality is reflected in the organization of the mining production and the spatial distribution of the ownership of mining related companies. According to the Chilean Internal Revenue Service (SII), the mining revenue generated by firms whose headquarters are located at Santiago, and most likely their owners too, was around 80 percent of the total revenues during the last decade (Fig. 1), while the rest 20 percent is generated by firms whose headquarters are located across the rest of the country where around sixty percent of the population lives and where practically all mining output is generated. Furthermore, this pattern has significantly increased in recent years, and the mining sector revenue share of the Metropolitan Region reached more than 91 percent in 2018, the last year for which there is official data available (Fig. 1).

The historical pattern of deep spatial inequality in Chile has been perpetuated by an extremely centralist institutional set-up (Atienza and Aroca, 2012) that is reflected in the essentially national approach for promoting and evaluating a mining development strategy (Gobierno de Chile, 2014). This centralist set-up also affects the spatially blind approach to the design of social policies and programs that tend to favor the main cities of the country, especially Santiago, leaving the rest of the territories behind in terms of access to public goods and equipment, and consequently in terms of quality of life (Paredes et al., 2016).

Together with these differences in regional wellbeing, it is important to consider the high and increasing cost of living caused by the recent

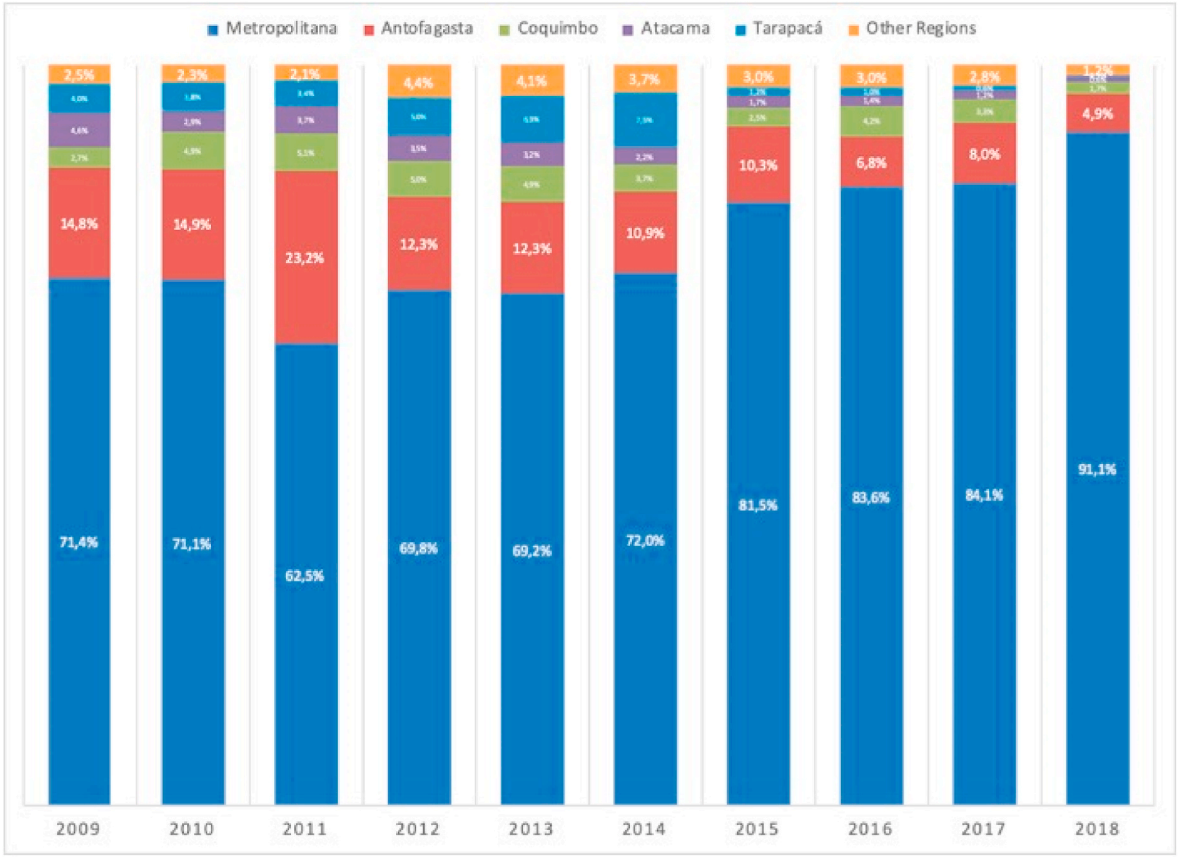

Fig. 1. Distribution of Revenue from Mining Sector Between Santiago and Regions.
Source: Authors based on SII, Chile.

mining prices supercycle in the case of mining regions. Fig. 2 shows the housing prices evolution across regions in Chile between 2000 and 2017 relative to the Metropolitan Region.[2] As Chile is geographically a long straight country, the graph can be read from left to right thinking as from north to south, where each vertical line represents a region. The graph shows that the housing cost goes up in extreme southern and northern regions. The Chilean mining regions are mainly composed by Antofagasta and its neighboring regions (Arica, Tarapacá, Atacama and Coquimbo) in the north of the country. Every line in the graph represents a year, showing high variation across the territory. However, while housing price was stable in non-mining regions during the whole period, mining regions presented a large variation. It is particularly relevant the case of Antofagasta where the cost of the housing was around 90 percent of similar houses in Santiago in 2000, while by 2013 houses in Antofagasta were 60 percent more expensive than in Santiago (value of 1.6 in the vertical axis). This change in the cost of living implies that the higher nominal income of mining regions has lower purchasing power than southern regions, affecting economic indicators related to income like poverty rate and wages (real), among others.

The lower level in the quality of life related to the provision of public goods, the negative externalities of the mining industry, and the increasingly higher cost of living in mining regions have led workers to intensify long distance commuting as a means to take advantage of the best of both worlds (higher wages of the mining industry and lower living costs in their regions of origin). In fact, in regions like Antofagasta, around 50 percent of mining workers lived in other regions of the country in 2018 (Atienza et al., 2020). This process, that has been also promoted by low fuel costs and mining company labor schemes increasingly relying on shift systems (Aroca and Atienza, 2011), have produced direct negative implications for the development opportunities of mining territories. Such negative implications include fly-over of wages out of the mining regions, the reduction in local demand and employment multiplier effects and the lack of development of thick local labor markets, among others.

All these elements together have reinforced the perception of people living in Chilean mining regions that most of the benefits associated to mining exploitation leave the mining regions and that the potential gains of the recent commodity prices supercycle have been wasted, jeopardizing the economic and social sustainability of mining regions and cities, and leading to new forms of enclave economies (Arias et al., 2014; Phelps et al., 2015). This situation is also manifested in the high level of social conflict existent in the Chilean mining regions during the last decade and in the current "social outbreak" where Antofagasta has been one of the most affected cities by violence in the country. According to register of conflicts across the Chilean territory between 2012 and 2017 created by COES,[3] the main four mining regions of the country (Antofagasta, Atacama, Tarapacá and Coquimbo) presented a proportion of conflicts 20 percent higher than the rest of the country. In conflicts related to collective bargaining, housing scarcity and pollution, the value was more than 40 percent. Two main mining-related factors are behind the rise of social conflicts in these mining regions: (1) factors related to labor market issues such as the level of wages and labor

[2] The housing price can be used as a proxy of the cost of living due to the fact that houses are non-tradable and represent a large share in the household budget.

[3] The Center for Study Social Conflict and Cohesion (www.coes.cl). The database contains the conflicts reported by the news media and some of the characteristics of it such as place, date, motives and duration.

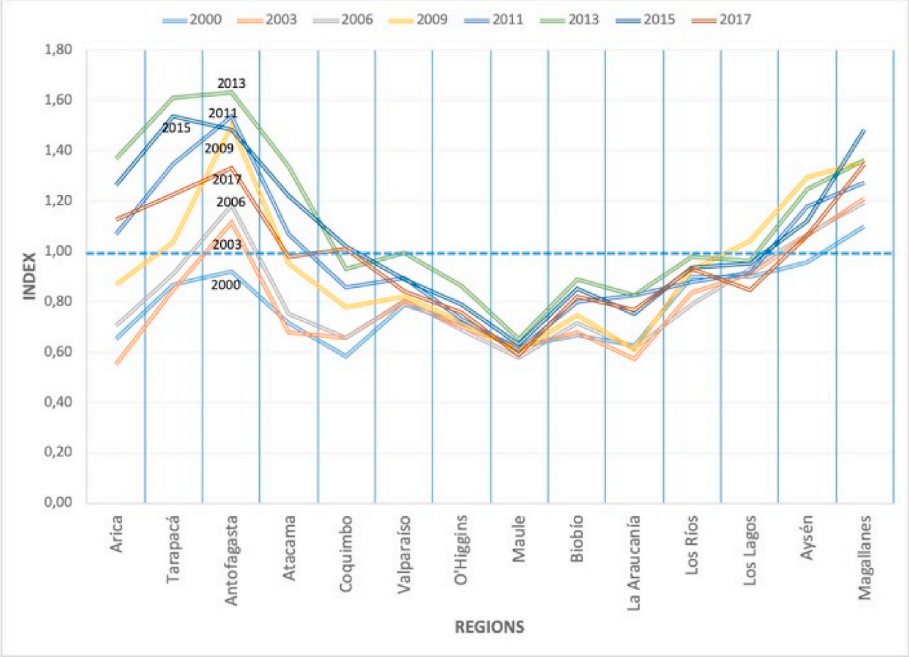

Fig. 2. Chilean Regional Housing Price: 2000–2017.
Note: Vertical axis captures the ratio of the median housing cost in the respective region to the median value in the Metropolitan region of Santiago. *Source*: López and Aroca (2019).

conditions (especially in the subcontracting and fly-in and fly-out labor schemes), as well as the risk associated with jobs (Paredes et al., 2018); and (2) factors associated to local development and environmental problems such as quality of life, pollution of specific areas, public funds and housing (Departamento de Estadísticas e Información de Salud, 2016; Vergara-Perucich and Arias-Loyola, 2019).

This brief account of the Chilean experience shows that when we just focus on the national dimension, we are missing an important part of the story of how mining can contribute (or not) to economic development, drawing attention to the incorporation of the territorial dimension as a necessary and complementary approach to this challenge.

4. A territorial turn in chilean mining studies – research from the SI

The aim of this SI is to analyze how mining activity is contributing to economic development in Chile from a territorial perspective. The articles included in this SI gives us an important grasp of some of the main topics that emerge when we make a territorial turn in the analysis of mining-based economic development and present at least three strands of research.

1. Research related to the analysis of the *interaction between the macro (national) and meso (regional) levels of analysis*, to understand how macroeconomic results differ across space. This type of studies is a point of departure to understand differences among regions and cities in relation to the evolution of the mining industry, that need to be complemented with studies that adopt a territorially-based approach to obtain a more detailed picture of the mechanisms that are at work to explain how the impact of the extractive activity differs across space.
2. Research connected to the *territorial consequences of the changes in the organization of the mining industry since 1990s* in Chile (but common to many other mining countries). In particular, the increasing externalization of jobs and the global fragmentation of production, in terms of production linkages, and the creation of technology intensive supplier firms in mining regions promoting competitiveness and the integration of these regions in global value chains. This analysis pays special attention to the uneven patterns of development across space and to the role of public policies in promoting linkages and innovation.
3. Research related to the *consequences of resources windfalls in mining regions and cities*, analyzing to what extend the increase in income, public funds and social corporate responsibility practices and contributing to increase local capabilities and quality of life. This area of investigation is currently controversial in Chile due to the widespread feeling in the population of mining territories that the price super cycle did not contribute to improve the opportunities of reaching an economic and social development.

4.1. The interaction between the macro and the meso scales

Fernandez, 2020 presents a general overview of the situation of the world copper market focusing afterwards on the case of Chile and paying special attention to the evolution of output, production costs, labor productivity and ore grades. She uses this background to make a dynamic analysis of employment linkages across economic sectors between 1986 and 2016, within and across regions, linked to the copper price cycle. Using concordance measures of employment during peaks and troughs in copper prices and rolling correlations, the author finds that employment linkages between the Antofagasta and Metropolitan Regions have diminished over time and also that employment concordance among some regions seems to be strongly related to the flows of long-distance commuters. In this sense, Fernandez, 2020 shows how the evolution of the local labor markets of regions that send a relatively high number of commuters to mining regions is strongly connected to the evolution of the mining regions. This result stresses the need of analyzing how the effect of mining commodity prices spread across space and not necessarily affect those regions strongly specialized in the mining industry.

Medina (2020) analyzes the interaction of the mining industry in Chile with the rest of the economy using a wide array of basic macroeconomic indicators between 1996 and 2005 the period before the

mining prices super cycle. This macroeconomic approach to the analysis of the resource curse gives us a general picture of the relevance of the mining industry for the Chilean economy. The author finds evidences that go against the hypothesis of a resources curse from a macroeconomic perspective. Based on diverse econometric techniques, Medina (2020) shows that the development of the Chilean mining industry had a positive effect on non-mining GDP, investment, fiscal revenue and labor markets, during the period of analysis. These positive effects were reinforced when considering the fiscal rule and the production interlinkages. The paper then expand the analysis to explore the differences across regions of the country. Despite finding a positive effect of mining activity across territories, the author finds a smaller GDP multiplier of mining production in northern regions –where extractive activity is concentrated– and that aggregate macroeconomic benefits tends to be higher in regions where mining activity has been less predominant.

In the same line, Álvarez et al., 2020 analyze the impact of changes of metal-mining prices on poverty rates at a municipal level using household data from 1998 to 2013. The authors apply a difference-in-difference approach by exploiting the differences between municipalities given their exposure to mining prices. The authors investigate which are the potential mechanisms that explain the relationship between commodity prices and poverty at a local level paying attention to the evolution of local labor markets in terms of employment and wages. The results show that the increase in mining prices since 2003, at the beginning of the super cycle, significantly reduced poverty rates in the municipalities that were more exposed to changes in mineral prices. This positive effect is principally explained by increases in the demand and wages of unskilled worker in the mining industry rather than due to indirect effects on other regions related to increases in mining linkages with other industries. Future research in this topic can explore, among other issues, what has happened with poverty rates since the end of the super cycle; to what extent these results spread to those regions sending long distance commuters to work in mining regions; and how poverty rates reduction could be affected by differences in the cost of living across municipalities.

4.2. Linkages, innovation and territorial competitiveness

From a national perspective, some authors have proposed that increasing externalization in the mining industry is an opportunity for increasing mining linkages, especially for those related to intensive technology (e.g. Morris et al., 2012). This optimistic view of mining-based economic development is contested by Atienza et al., 2020 who show, using input-output matrices, that mining linkages in Chile has decreased since 1995 and especially during the mining commodities super cycle. The authors show how this trend is more pronounced in mining regions, pointing to the lack of a competitive mining services industry in Chile, which remains strongly dependent on foreign investment and know-how. Furthermore, Atienza et al., 2020 show, using a sample of almost 4000 mining services suppliers, that the potential for establishing links across technology intensive mining firms is highly constrained in the case of mining regions due to the extreme spatial concentration of mining service suppliers in Santiago and to the functional specialization of mining regions in services with a lower technological content, more routine and easily substitutable tasks such as construction, maintenance and repair. This paper shows a clear-cut hierarchy of places, both at international and national scales, that creates uneven opportunities of development through mining. In this sense, since the opportunities to promote mining linkages are unevenly distributed across space, specific place-based policies are needed to integrate mining services suppliers in global value chains and achieve a more even territorial development. This cross-links multiscalar approach to the analysis of the mining industry provides key insights to better understand the mechanisms that explain some results observed at a macro scale.

In the same line, Bravo-Ortega and Muñoz (2020) uses a more institutional and historical approach to evaluate mining-related public policies implemented in Chile since the 1990's and how they have contributed to promote and increase production linkages, with special emphasis in the case of knowledge-intensive mining services. This analysis confirms again that linkages have not increased as expected by policy makers and that the development of a competitive domestic mining services industry is not taking place in mining regions and that in overall is still far from the experience of countries such as Australia. Based on an analysis of public reports related to the national strategy of mining development and on semi-structured interviews to mining services suppliers, Bravo-Ortega and Muñoz (2020) analyze how the Chilean institutional set-up regulates the interaction between the national and sub-national scales within the country. Results show that the territorial dimension is not a relevant part of mining-related public policy that pragmatically conceives as if mining were homogeneously distributed across space. This spatially blind approach to mining development is based on strategic guidelines that are excessively broad and that finally are doomed to fail in the promotion in mining linkages particularly in resources peripheries. As pointed by Auty and Furlonge (2019), this type of studies based on the institutions from a historical perspective are important complements to quantitative research approaches, which is essential to understand in more depth how and to what extent policies and mining industry decisions contribute (or not) to overcome the resource curse.

4.3. Local capabilities and quality of life in mining territories

The effects of mining commodity price booms and busts on the evolution of urban agglomerations in mining regions are still an underresearched topic that is directly related to the economic and social sustainability of mining cities. Rehner and Rodríguez (2020) study the channels that explain urban growth in mining cities using the "Dutch disease" and the "second circuit of capital" theories. The authors analyze the evolution of three cities from northern mining regions in Chile: Antofagasta, the main mining city of the country; Copiapó where small and medium mining companies predominate; and La Serena, a main residential hub for mining commuters working in other regions. Using standard econometric techniques with data spanning 10 years (2005–2015), the authors find that growth in real estate investment is mainly related to financial liquidity at a national level and local wages, and to a lesser extent to copper exports. Thus, they argue that spillovers from mining to urban economies are mainly channeled through household's income and its distribution across space. Interestingly, Rehner and Rodríguez (2020) results show significant differences in the evolution of the cities analyzed and only find evidence of a debt-driven growth in one of them. This type of study stresses the relevance of considering different types of mining urban agglomeration and the need of taking into account the functional interaction among urban nodes through financial and labor markets.

Oyarzo and Paredes (2020) study one of the traditional topics related to the resource curse at a local level: are resource windfalls of the mining industry beneficial for the communities receiving these funds? In this case, the authors analyze whether the extra-taxes collected by mining municipalities in Chile have a positive or negative causal effect on public education indicators and consequently to a better provision of public goods. The Chilean congress proposed in 2010 a classification of the municipalities as either mining or non-mining depending on the size of the collected mining taxes. Using this exogenous rule, Oyarzo and Paredes (2020) implement a 'regression discontinuity design' econometric model to identify the causal effect of extra-funds on public education indicators. Results show that, despite the increase in local revenues from taxes, the educational performance of mining municipalities is worse than that of their counterfactuals (non-mining municipalities). In addition, the authors do not find significant evidence of mining municipalities investing more resources in public education than other municipalities. This type of impact assessment research is still scarce in

the Chilean case, which is an important gap that Oyarzo and Paredes (2020) address as it is essential to evaluate and understand why mining communities are not necessarily able to take advantage of resource windfalls. Further research on institutional and policy design is needed.

Devenin (2020) analyzes a widely controversial topic that has also been scarcely studied in Chile, corporate community development strategies. She analyzes the cases of "Creo Antofagasta" and "Calama Plus", two of the main initiatives in this field focused on the improvement in the quality of life in these two cities in northern Chile. While it is still too soon to make a complete assessment of the results of these long-term programs that have been controversial from the way the community participates and is integrated in their activities, Devenin (2020) proposes an innovative model of corporate community development (the collaborative community development model) to generate shared value and create long-term relationships with communities. This long-term perspectives and strategies are essential in Chile, where both public and private initiatives related to mining based economic development tend to be myopic and has a top-down design.

5. Concluding remarks on the relevance of this SI

The articles presented in this SI are a good sample of the many research questions that arise when considering the territorial dimension of mining-based economic development as a complement to the dominant national perspective. Mining is an activity that directly and indirectly affects the economy of hosting (and surrounding) regions in ways that many times are not perceived in macroeconomic indicators. In addition, centralized government systems that many times impose homogenous spatial-blind development policies are features not only of the Chilean experience, but of the development of many mining countries around the globe. The papers on this SI shed some lights on ways to identify and address the territorial disparity of mining and regional development.

Other the topics that deserve further attention from this perspective are:

- what the role of the state and public mining companies are in mining-based development;
- how mining regions are able to diversify and create new industrial paths;
- how institutions and corporative practices are promoting the capture of mining rents and value in the main urban agglomeration in detriment of mining territories;
- how regional and national institutions co-ordinate to avoid uneven patterns of development across space;
- how long-distance commuting need to be regulated to avoid the fly-over of workers and resources from mining regions;
- how mining territories are compensated of mining environmental negative externalities;
- what the best practices are to avoid the formation of new varieties of mining enclaves and sacrifice zones;
- how place-based policies can be complemented with horizontal national polices to increase the quality of life and the capabilities installed in mining regions;
- to what extent regional local content policies are an option to promote mining linkages and innovation;
- what are the most fruitful forms of interaction between the mining companies and local communities.

In the end, the aim of all these questions is understanding to what extent is possible to achieve an economic, social and environmentally sustainable development in mining territories and, as a consequence, how these territories can contribute to national development. The papers from this special issue in addition to contribute to this debate and provide novel methods to address research in this area, are an invitation to combine both national and subnational scales in the analysis of the mining industry and to avoid one-dimensional and spatially blind approaches. Chile is an interesting research case for this disjunctive, but findings of the SI papers and future research needs apply to most mining economies across the globe.

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